Induction of a Proton Gradient Across a Gold Supported Biomimetic Membrane by the Electrocatalytic Activity of *Desulfovibrio vulgaris* [NiFeSe] Hydrogenase

A. L. De Lacey[a*], O. Gutiérrez-Sanz[a], P. Natale[b], I. Márquez[a], M. C. Marques[c], S. Zacarías[c], M. Pita[a], I. A. C. Pereira[c], I. López-Montero[b], M. Vélez[a]
[a]Instituto de Catálisis y Petroleoquímica, CSIC, c/ Marie Curie 2, 28049 Madrid (Spain)
[b]Universidad Complutense de Madrid, Avda. Complutense s/n 28040 Madrid (Spain)
[c]Instituto de Tecnologia Quimica e Biologica, Universidade Nova de Lisboa
Apartado 127, 2781-901 Oeiras (Portugal)
e-mail address: alopez@icp.csic.es

Energy transduction mechanisms in living organisms, such as photosynthesis and respiration, store light and chemical energy in the form of an electrochemical gradient formed across a lipid bilayer.[1] We show that the proton concentration in an electrode/phospholipid bilayer interface can be controlled and monitorised electrochemically by immobilizing the membrane-bound [NiFeSe] hydrogenase from *Desulfovibrio vulgaris* Hildenborough.[2] The electro-enzymatic oxidation of H_2 generated a proton gradient across the supported biomimetic membrane that was coupled to the *in vitro* synthesis of ATP.[3]

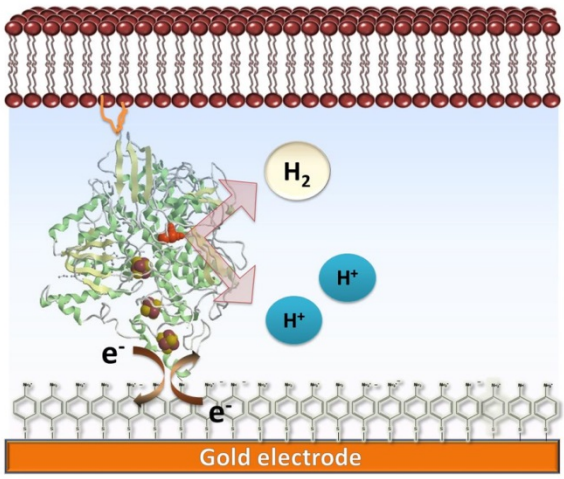

Figure 1 Scheme of proton gradient generation by membrane-bound [NiFeSe] hydrogenase immobilized on a modified gold electrode

1 P. Mitchell, J. Moyle, *Nature* **1967**, *213*, 137.
2 O. Gutiérrez-Sanz, C. Tapia, M. C. Marques, S. Zacarias, M. Vélez, I. A. C. Pereira, A. L. De Lacey, *Angew. Chem. Int. Ed.* **2015**, *54*, 2684.
3 O. Gutiérrez-Sanz, P. Natale, I. Marquez, M. C. Marques, S. Zacarias, M. Pita, I. A. C. Pereira, I. López-Montero, A. L. De Lacey, M. Vélez, submitted.